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BRIEFER ARTICLES.

FERN VARIATION IN GREAT BRITAIN.

UP to a comparatively recent date, the departures from the normal type of ferns which were found growing wild under perfectly natural conditions received little or no attention from professional botanists, but were simply dubbed "monstrosities" and left to amateurs to collect, cultivate, and observe. Eventually, however, the discovery that these "sports" did not always merely involve a superficial change of form, but also that this change was in some cases correlated with hitherto unknown modifications and abridgments of the normal life cycle, led to a greater interest being taken, with the result that theories as to the origin of alternation of generations were seriously affected. Before these investigations and discoveries, it was assumed that the life cycle was necessarily spore, prothallus, fertilized egg, and finally the sporophyte or fern proper. Apogamy, however, discovered by Professor Farlow, eliminated the sexual act, a vascular structure originating in the prothallus which resulted in an asexual bud, whence at once arose the sporophyte, the life cycle then being spore, prothallus, sporophyte. This, though first remarked in a normal *Pteris cretica*, was subsequently found by DeBary to occur with seeming constancy in an abnormal tasselled form of Lastrea (*L. pseudo-mas cristata*) and several other species normal and abnormal. The next discovery was that of soral apospory by the writer, on a form of *Athyrium filix-foemina*, which shortened the life cycle in another way altogether, by eliminating the spore, masses of prothalli being produced, as Professor F. O. Bower subsequently ascertained, from the stalks of aborted sporangia, on the ordinary soral sites.[1] Here the life cycle runs thus, sporophyte, sorus, prothallus, fertilized egg, sporophyte. No sooner was this phenomenon announced than Mr. G. B. Wollaston reported the still more remarkable case of apical apospory in a form of *Polystichum angulare* (*P. ang. pulcherrimum*), in which the abnormally long sickle-shaped pinnules

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[1] DRUERY, C. T.: Jour. Linn. Soc. **21**: 354. 1884; **22**: 427–440. 1885. BOWER, F. O.: Trans. Linn. Soc. **2**: 301–326. 1887.

had their terminal and segmental apices dilated into prothalli, which when layered ran the normal course, with the exception that resulting plants were invariably defective and depauperate. Here the sorus is eliminated, and the prothalli are produced altogether independently of the usual reproductive sites, by a modification of the tissue of the sporophyte. Several quite independent finds of the *pulcherrimum* type existed, and in every case apical apospory was found to be correlated with it, and furthermore soral apospory existed on the fertile fronds. The modifications of the life cycle, however, were not even yet exhausted, for curiously enough a sporeling of the apogamous variety of Lastrea above mentioned was found by the writer to bear a well developed prothallus at the tip of its first frond, and the second and third bore prothalli, even profusely, on their surfaces, a sort of prothallic rash as it were.[2] These produced a brood of plantlets, but one and all lost this aposporous character and assumed the merely crested type of the parent as their later fronds arose. Here as we have apogamy and apospory associated, the life cycle dwindles down to sporophyte, prothallus, sporophyte, the shortest possible cut except the bulbils on the fronds of viviparous ferns, which have no intermediate stage at all. Subsequently, the writer found both soral and apical apospory on another variety of Athyrium, and apical on a fimbriate form of Scolopendrium.[3] Curiously enough, subsequent to the discovery of the aposporous Lastrea, a sporeling of the same parentage originated in Mr. Cropper's collection, which was and is profusely prothalliferous from all apices, the smallest piece of frond forming a mass of prothalli when layered, which creeps about Marchantia-like and yields a perennial crop of typical plants. Finally, in this connection, Professor Farlow found an aposporous (soral) type of *Pteris aquilina*. Subsequently, at Professor F. O. Bower's suggestion, Mr. W. H. Lang commenced a series of investigations in connection with the prothalli produced from spores of abnormal varieties, and thereby practically completed the series of abnormal modifications of the life cycle, by finding in more than one species prothalli bearing developed sporangia and spores,[4] thus cutting out the sporophyte, and reducing the life cycle to spore, prothallus, spore, an absolute minimum. I must refer to Mr. Lang's papers for the most interesting details of these and other vagaries, and will merely add that on one and the same prothallus several different modes of reproduction were found, namely, asexual bulbils, some producing fronds and others merely roots; other prothalli budding out from the surface; and sporophytes sexually developed; all these on prothalli which themselves were thick cylindrical fleshy masses instead of the normal flat cordate thallus, while archegonia, antheridia, and sporangia were indiscriminately dotted about among the other varied growths.

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[2] DRUERY, C. T.: Jour. Linn. Soc. **29**:480–482. 1892.

[3] DRUERY, C. T.: Jour. Linn. Soc. **30**:281–284. 1892.

[4] LANG, W. H.: Proc. Roy. Soc. **63**:56–61. Phil. Trans. Roy. Soc. Ser. B. **190**: 187–238. 1898

The above facts are cited merely as a prelude and justification for the suggestion that in the study of American species the varieties should have due attention and not be labeled "monstrosities," and ignored as they were in Great Britain for a very long period. The writer has repeatedly urged and urges once more that it is quite as much, if not more, in the direction of nature's exceptions that we should seek the key to many of her secrets. Certainly in the study of the abnormal fern types alluded to, a number of new and unexpected facts have cropped up, which largely modify previous ideas regarding fern reproduction, not one of the links in the normal life cycle being absolutely essential. Spore, prothallus, egg, sporophyte, have all in turn been shown to be superfluous, the fern in one shape or another reproducing itself without them.

As regards the great number of varietal forms which have originated in Great Britain, there is little doubt that it is due far more to the continued existence of a coterie of persistent variety hunters than to any predisposing elements in the environment. The traveling botanist is rarely a variety hunter, but a species hunter, hence he does not in a habitat full of known species examine them plant by plant, or scan them with a peculiarly trained eye, as would the hunter for sports. If he have such an eye and a taste for varieties, we have the evidence that "finds" will crop up abroad as well as at home. Witness Mr. George Brown, who found *Woodwardia radicans cristata*, two finely crested forms of *Lastrea dilatata*, and two tasseled forms of *Aspidium hemionitis* in the Azores; while the writer, hunting in all for about two hours recently in Fayal (Azores), found a clump of *Aspidium hemionitis* beautifully tasseled throughout, and a fine pendulous polydactylous variety of *Pteris aquilina* which lined the high road for fifty yards. This being so I would advocate variety hunting in the United States as a pursuit likely to reward its votaries not merely with very beautiful types for their collections, but also with material well worthy scientific attention. Thanks to some short notes sent to the *Fern Bulletin*, I have received already fronds of a crested Athyrium found by a lady, and plants of *Denstaedtia punctilobula cristata* and *Phegopteris hexagonoptera truncata*, the latter found by Mr. W. R. Maxon on the Potomac, which have originated in the United States as wild sports, a proof that such sports exist. At the same time, however, I note that much stress is laid upon doubtful subvarieties, which a wider knowledge of marked ones would probably minimize considerably. In my own fern hunting expeditions I invariably come across subvarieties in which the cutting is more or less modified; but with the abundance of really marked types in mind, these are simply noted and left. As exemplifying this abundance the figures from Mr. G. I. Lowe's *British Ferns*, a descriptive list published in 1891, may be appropriately quoted.

	No. of vars.
Pteris aquilina	17
Adiantum capillus-Veneris	34
Asplenium adiantum nigrum	16
trichomanes	27
maximum	28
Athyrium filix-foemina	313
Scolopendrium vulgare	450
Polystichum aculeatum	34
angulare	394
Lastrea filix-mas	54
pseudo-mas	42
propinqua	28
montana (oreopteris)	77
dilatata and others	57
Polypodium vulgare	74
Other varieties of sundry species	214
Total	1859

Upon analysis it is found that 1119 of these were wild finds, without reckoning additional independent finds of forms too similar to differentiate. This list cannot be regarded as exhaustive, and we may safely reckon the distinct varieties at over 2000, and the wild finds at 1500. As a concrete example of what one man can do in a single district, Mr. J. Moly, of Langmoor in Dorset, is credited with no less than 600 distinct finds in that and adjoining counties. His near neighbor, Dr. Wills at Chard, found several hundred more. The numbers, however, represent the outcome of many years of persistent search, which, however, could not have been exhaustive, as it is recorded that Mr. Patey, visiting Mr. Moly, found one of the finest of all types (*P. ang. plumosum* Patey) in Mr. Moly's own hedge, while Dr. Wills was indebted to a farm laborer for that unique fern *P. ac. pulcherrimum*, also found in a hedge close to his house, and thought to have a funny look about it by the finder. Finally as an inducement to fern hunting, we have the incontrovertible fact that many of these wild sports are far more beautiful than the normal forms, and as such constitute decorative foliage plants of highest merit.

A word may be added in reference to the soral bulbils, as these occurrences should afford good material for the morphological study of the sporangium. Professor Bowers' monograph on apospory and allied phenomena, already cited, gives some illustration of this, and the writer's previous paper[5] also alluded thereto. Since then, however, such soral bulbils have been recorded as occurring on *Adiantum capillus-Veneris* vars. *daphnites* and *imbricatum*, and on *Polypodium vulgare elegantissimum*, while most of the *superbum* section of plumose Athyria have inherited the capacity from the original wild Axminster find. In all these cases the bulbils are seated on the soral sites, and are usually accompanied by sporangia grading from imperfect and aborted ones to perfect ones with full complement of perfect spores which germinate freely and yield fairly typical plants. In the case of the Polypodium, such bulbils occur only on the most highly developed fronds, and on pinnules of extremely fine cutting, the terminals of which run out into nearly inch long lingual extensions, pointing I think to aposporal tendencies. The sori are massive and consist of filamentous processes some of which lengthen out into fronds, while others form perfect sporangia of normal golden yellow color. Here then do not appear those massive cellular growths which are found on the Athyria, but in time one bulbil gets the predominance and a little plant of several small fronds is developed. Unfortunately, neither my leisure nor my training permit me to investigate properly the transitional stages which must exist in cases like these, but I should be happy to provide material to any one who desires to follow up this line of research.— CHARLES T. DRUERY, 11 Shaa-road, Acton, London, W.

[5] Jour. Linn. Soc. **21**: 254. 1884.